

## **REMARKS**

The Office Action of September 15, 2003, is discussed in detail below.

### **Declaration under 37 CFR 1.132**

#### **From Paragraph 9 of Office Action**

**However, there is no X-ray diffraction or neutron diffraction or factual evidence to support Applicant's arguments. In addition, nothing in the declaration is specific about Mr. Pashmakov's expertise in the field of semiconductor material technology. The Examiner suggests that the statements in the declaration would be greatly persuasive if Mr. Boil Pashmakov establishes himself to be an expert in the semiconductor technology to which the claimed invention is related.**

Applicant has submitted a further Declaration under 37 CFR 1.132 from Dr. Boil Pashmakov pursuant to the Examiner's statements. Sub-paragraphs 1a, 2a, and 3d1 have been added to the declaration in response to the Examiner's statements. Sub-paragraph 1a provides further facts attesting to Dr. Boil Pashmakov's expertise in the field of semiconductor materials. Sub-paragraph 2a is a statement concerning Dr. Boil Pashmakov's familiarity and understanding of the Ozin reference presented by the Examiner in the Office Action of September 15, 2003. Sub-paragraph 3d1 points out portions of the specification that provide supporting evidence for the arguments presented by Dr. Boil Pashmakov in the Declaration. Applicant believes that the Declaration adopts the Examiner's suggestions, is persuasive, and requests entry of the Declaration.

### **Finality of Rejection**

#### **From Paragraph 10 of Office Action**

**Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, THIS ACTION IS MADE FINAL. See MPEP § 706.07(a)**

Applicant respectfully submits that the final rejection presented by the Examiner is premature and requests that the final rejection be withdrawn. In applicant's reply dated 13 June 2003, applicant presented new claims 35 – 38 (p. 8-9 of applicant's reply of 13 June 2003). The Office Action dated 15 September 2003 in which the final rejection was presented lacks an examination of new claims 35 – 38 and incorrectly states in item 4 of the Office Action Summary (PTOL-326) that only claims 1 – 20 and 31 – 34 is/are pending in the application. Applicant requests examination of new claims 35 – 38 and further requests designation of these claims as pending in the application.

### **Claim Rejections – 35 USC 103**

#### **From Paragraph 3 of Office Action**

**Claims 1 –19 and 31 – 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ovshinsky et al. (US 6,087,580) in view of Ozin et al. (US 5,320,822).**

US 6,087,580 to Ovshinsky et al. ("Ovshinsky") is directed to a non-single-crystal silicon alloy material including regions of intermediate range order (IRO) silicon alloy material where the IRO material is a material having atomic aggregations of very short range periodicity that is comprised of a plurality of highly ordered, relatively small atomic aggregations that are characterized as ordered clusters. (Ovshinsky (col. 6, lines 1 – 6 and col. 4, lines 38 - 42)). Ovshinsky fails to teach applicant's distorted tetrahedral bonding configuration. US 5,320,822 to Ozin et al. ("Ozin") discloses a crystalline microporous solid having an ordered framework

structure that possesses both regular and distorted tetrahedral symmetry of the bonding configuration (col. 4, lines 30 – 40).

Applicant respectfully maintains that the Examiner has failed to establish a prima facie case of obviousness. Applicant points to two elements, either of which suffices to demonstrate failure to establish a prima facie case of obviousness, in support of his opinion. Applicant argues first that the Ozin reference applied by the Examiner corresponds to non-analogous art and then argues a lack of motivation to combine the Ozin reference with the Ovshinsky reference. Applicant's arguments pertaining to these two elements follow.

#### **Application of Reference Drawn from a Non-Analogous Art**

Applicant maintains that the Ozin reference is non-analogous art and accordingly, that the Ozin reference is not properly applied in support of the Examiner's 103(a) rejection. As stated in MPEP 2141.01(a), "In order to rely on a reference as a basis for rejection of an applicant's invention, the reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the inventor was concerned."

Applicant's remarks with respect to these two elements follow.

#### ***Applicants' Field of Endeavor as Distinguished from Ozin's***

Applicant's field of endeavor is semiconductor materials. (Selected citations from Applicant's specification: "Semiconductor with Coordinatively Irregular Structures" (Application title); "This invention relates generally to semiconductor materials with novel properties and internal structures." (p. 1, first sentence of FIELD OF INVENTION portion of Applicant's specification); "The present invention concerns a non-single crystalline semiconductor material ... (p.8, line 2 of Applicant's specification).) Central to the semiconductor arts are the optical and electrical properties of semiconductors. Key considerations to persons of skill in the

semiconductor arts include the bandgap, electrical conductivity, optical absorption, doping, and lasing properties of semiconductors and the design of new semiconductor materials emphasizes the utilization of chemical and physical modifications to achieve variations in or improvements of one or more optical or electrical properties.

In the instant application, Applicant seeks to modify the properties of semiconductor materials through the stabilization of coordinatively irregular structures having unusual bonding configurations that lead to novel properties. (“By controlling the size of constituent coordinatively irregular structures, the regularity of chemical bonding within the constituent coordinatively irregular structures, the size distribution of coordinatively irregular structures within a semiconductor body, and interactions between constituent coordinatively irregular structures within a semiconductor body, it is possible to control the electronic properties of semiconductor materials with this invention. Since the coordinatively irregular structures possess an unusual type of chemical bonding characterized by variable distortions from regular tetrahedral coordination and a state of order intermediate between the crystalline and amorphous forms of silicon, the coordinatively irregular structures, and assembly thereof to form the ultimate semiconductor body of the present invention, possess heretofore unrealized electronic properties that are useful in a variety of devices including solar cells, photovoltaic devices, lasers, LEDs, transistors, and diodes.” (p. 8, lines 9 – 20 of Applicant’s specification); “Since the electronic properties manifested by the ultimate semiconductor body depend cumulatively and synergistically on the electronic properties of the constituent coordinatively irregular structures assembled therein, the present invention permits the preparation of a large number of materials with a wide range of properties.”(p.10, lines 4 – 7 of Applicant’s specification)).

The field of endeavor of the Ozin reference is crystalline microporous solids. (“This invention relates to the synthesis of crystalline microporous solids in a growth medium” (col. 1, lines 15 – 16)). According to Ozin (col. 4, lines 31 – 33): “... a “crystalline microporous solid” is defined as a solid which possesses a defined and ordered crystalline framework structure within which there is a regular array of cavities, channels or pores”. Of central concern to persons in the art of crystalline microporous solids is the shape, size, geometry, and contiguousness of the porous regions (i.e. cavities, channels or pores and the physical dimensions thereof) present within a crystalline microporous solid. Interest in the features of the porous regions follows from the underlying motivation driving the field of crystalline microporous solids; namely, the porous regions render crystalline microporous solids suitable as host materials in the formation of host-guest complexes. In a host-guest complex, the host material acts as a container or cage for guest molecules. The guest molecules penetrate the porous regions of a microporous host solid and become physically entrapped therein to form a host-guest complex.

Host-guest complexes are widely used in the chemical arts for catalysis. (“Crystalline microporous solids are well-known for their utility as heterogeneous catalysts in industrial organic processes ...” (col. 1, lines 19 – 21 of Ozin)). Host-guest complexes also find wide use in the physical separation of mixtures. Zeolites and molecular sieves are examples of microporous solids suitable for catalysis and separations. (“Moreover, zeolites and molecular sieves are useful as adsorbents for purifying gases, useful for separating mixtures of chemicals and isomers, useful as supports for catalytic metals and metal compounds and useful for ion exchange.” (col. 1, lines 26 – 31 of Ozin)).

In catalysis, a guest reactant molecule enters a porous host and becomes entrapped therein. Chemical interactions between the guest and host activate the guest molecule to render it more

reactive, thereby catalyzing its reaction. In physical separations, one or more guest molecules within a mixture of chemical species enters the porous regions of a microporous solid and is thereby removed from the mixture to effect a separation. Key concerns for persons in the field of microporous solids is designing the size, shape, geometry, length etc. of porous regions to provide for the selective penetration of targeted guest molecules within the channels, cavities and pores of the microporous solid to achieve selectivity with respect to guest molecules for the purposes of chemical reaction or physical separation.

The specific embodiments disclosed by Ozin pertain to silicate and aluminosilicate solids formed from silica ( $\text{SiO}_2$ ), or a combination of silica and alumina ( $\text{Al}_2\text{O}_3$ ), and other ingredients such as mineralizers and stabilizers. Silicate and aluminosilicate solids are oxides having a large bandgap. Accordingly, silicate and aluminosilicate solids are electronic insulators, rather than semiconductors, and provide no teaching pertinent to the field of semiconductor materials. Applicant maintains that persons in the field of semiconductor materials would not look to the field of microporous solids for guidance on electronic properties of semiconductor materials.

Whereas persons in the field of semiconductor materials are concerned with the optical and electrical properties of semiconductor materials, persons in the field of microporous solids are concerned with the physical dimensions of internal porous regions, the physical entrapment of guest molecules and the chemical and physical interactions between guest molecules and host microporous solids. Applicant is unconcerned with the ability of his claimed semiconductor material to entrap guest molecules in porous regions or with the ability of his claimed semiconductor material to selectively attract or repel one or more guest molecules from a mixture of chemical species or with the physical dimensions of internal porous regions. Applicant's claimed semiconductor material is thereby structurally distinguished from the

microporous solid of Ozin. Applicant is further unconcerned with the ability of his claimed semiconductor to function as a chemical catalyst or a molecular sieve. Likewise, persons of skill in the art of microporous solids are unconcerned with the bandgap, electrical conductivity, optical absorption and related properties of microporous solids. The function of Applicant's semiconductor material is thereby distinguished from the function of the microporous solid of Ozin. Applicant accordingly submits that Applicant's field of endeavor is distinguished from the field of endeavor of Ozin.

***Applicants' Problem of Concern as Distinguished from Ozin's***

Applicant further maintains that Ozin is not pertinent to the problem with which Applicant is concerned. Applicant is generally concerned with semiconductor materials suitable for photovoltaics, and more specifically, with semiconductor materials suitable for solar energy applications. Silicon is currently the most widely used material for solar energy applications and the prior art teaches use of crystalline silicon and amorphous silicon for photovoltaic and solar energy applications. Applicant has identified deficiencies in the use of crystalline and amorphous silicon for photovoltaic and solar energy applications. ("The primary limitations of single crystalline silicon for photovoltaic applications are its indirect bandgap and the inability to produce it in large areas in a continuous manufacturing process." (p.2, lines 1 – 3 of Applicant's specification); "From the viewpoint of solar energy applications, amorphous silicon is not an optimal material because it does not absorb the full range of photon energies present in the solar spectrum. Since amorphous silicon has a bandgap energy of approximately 1.8 eV, it is only capable of efficiently absorbing light with photon energies greater than about 1.8 eV. (The UV and higher energy visible portions of the solar spectrum.) The solar spectrum, however, contains a significant amount of light with photon energies less than 1.8 eV. (The lower energy visible

and infrared portions of the solar spectrum.) As a result, solar energy devices incorporating only amorphous silicon capture only a limited fraction of the total energy available from sunlight.” (p.4, lines 7 – 14 of Applicant’s specification)).

Applicant’s invention is concerned with the development of a semiconductor material having improved absorption of the solar spectrum. (“Based on the prior art, it would be desirable to have a material, that does not include Ge, with sufficiently strong absorbance in the red and/or near-infrared to be useful in solar energy and photovoltaic devices. A material capable of absorbing as many of the photon energies of the solar spectrum not absorbed by amorphous silicon is preferred. Ideally, the material should be readily integrable with amorphous silicon to expedite and economize the processing of multilayer structures.” (p. 5, lines 10 – 15 of Applicant’s specification). Applicant’s invention is directed at the problem of modifying the bandgap of semiconductor materials so that greater absorption of the solar spectrum occurs. (“The present invention permits control of the chemical bonding, structural distortions, state of order and hence, the bandgap and other electronic properties of semiconductor materials.” (p. 21, lines 3 – 5).) More specifically, Applicant’s invention seeks to provide a semiconductor material having improved absorption in the red and near-infrared portions of the solar spectrum. Applicant solves the problem of achieving improved absorption in the red and near-infrared portions of the solar spectrum by modifying the bandgap of semiconductor materials through the stabilization and incorporation of Applicant’s novel coordinatively irregular structures. (“The novel electronic properties of the semiconductor body of the present invention, including the improved absorbance in the red and near-infrared of the non-single crystalline silicon embodiment of the present invention relative to amorphous silicon, are a consequence of the unexpected properties



associated with the reduced dimensionality of the coordinatively irregular structures assembled within the semiconductor.” (p. 25, lines 14 – 19 of Applicant’s specification).)

Ozin, in contrast, seeks to solve the problem of increasing the crystal size and phase purity of microporous solids. (“Accordingly, a need exists to find a general method of growing crystalline microporous solids which leads to purer phases and crystals of at least about 0.1 mm, and preferably at least about 0.3 mm, in size.” (col. 3, line 68 – col. 4, line 3 of Ozin); “In fact, the microporous crystalline solids grown by the process described herein possess the largest synthetic crystal sizes known at this time” (col. 4, line 68 – col. 5, line 2 of Ozin).) In particular, Ozin seeks to obtain large crystal sizes and pure phases through manipulations of the crystal growth process and chemistry of crystallization; preferably through a non-aqueous reaction scheme. (“In a preferred aspect, this invention is a process of growing a crystalline silica microporous solid.” (col. 5, lines 19 – 20 of Ozin); “While the intention of this invention is to grow crystalline microporous solids in a non-aqueous environment ...” (col. 10, lines 45 – 47 of Ozin).) Ozin is thus directed at solving the problem of growing large and pure crystals of crystalline microporous solids through manipulations of reaction conditions and growth media. Ozin provides no teaching of electronic properties. Applicant accordingly submits that Applicant’s field of endeavor is distinguished from the field of endeavor of Ozin.

Applicant has shown that the Ozin reference is not in Applicant’s field of endeavor and is not pertinent to the problem with which Applicant is concerned. Substantial differences in both the structure and function of Applicant’s claimed semiconductor and the crystalline microporous solid of Ozin have been demonstrated. Applicant contends that persons in the art of semiconductor materials would not look to the art of microporous solids for guidance on bandgap modification, absorption of the solar spectrum and electronic properties generally.

Applicant thus respectfully maintains that the Ozin reference is non-analogous art and accordingly, is not properly applied in support of the Examiner's 103(a) rejection.

**Lack of Motivation to Combine the Ovshinsky Reference with the Ozin Reference**

Applicant maintains that there is no motivation to combine the Ovshinsky reference with the Ozin reference and that the rejection under 35 U.S.C. 103(a) is accordingly improper for failure to establish a prima facie case of obviousness. As stated in MPEP 2143, "To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

The mere presence of the semiconductor material of Ovshinsky and the distorted tetrahedral bonding configuration of Ozin in the prior art does not provide adequate motivation to combine the references. (MPEP 2143.01: "The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination"; see also *Uniroyal, Inc. v. Rudkin-Wiley Corp.* 837 F.2d 1044, 1051-2 (Fed. Cir. 1988): "it is impermissible to reconstruct the claimed invention from selected pieces of prior art absent some suggestion, teaching or motivation in the prior art to do so; MPEP 2143: "The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure.").

A proper motivation to combine Ovshinsky with Ozin thus requires a showing of the desirability of making the combination. The desirability is best shown through a teaching or suggestion that some beneficial effect flows or is expected to flow from the combination of

references. (MPEP 2144: “The strongest rationale for combining references is a recognition, expressly or impliedly in the prior art or drawn from a convincing line of reasoning based on established scientific principles or legal precedent, that some advantage or expected beneficial result would have been produced by their combination.”) Ovshinsky teaches a semiconductor material, while Ozin teaches a distorted tetrahedral bonding configuration in a crystalline microporous solid. Although Ozin teaches a distorted tetrahedral bonding configuration, Ozin fails to teach or suggest a relationship between a distorted tetrahedral bonding configuration and the bandgap or other electronic properties of a semiconductor material. Ozin, in fact, fails to teach any benefit for his distorted tetrahedral bonding configuration, only mentions or makes reference to a distorted tetrahedral bonding configuration in two places of his specification (col. 4, line 40 and col. 10, line 64) and makes no arguments concerning the criticality or uniqueness of properties that accompany his distorted tetrahedral bonding configuration. Ozin thus fails to teach or suggest a benefit associated with his distorted tetrahedral bonding configuration. Ovshinsky further fails to teach or suggest the use of bonding configurations drawn from the art of microporous solids as a vehicle for modifying the bandgap or other electronic properties of semiconductor materials. The prior art thus does not show the desirability of combining the semiconductor material of Ovshinsky with the distorted tetrahedral bonding configuration of Ozin and thus fails to provide a motivation to combine the Ovshinsky reference with the Ozin reference.

In view of the foregoing arguments, Applicant respectfully maintains that the Examiner has failed to establish a prima facie case of obviousness. Applicant has shown that the Ozin reference corresponds to non-analogous art and is therefore improperly applied in support of the Examiner’s rejection under 35 U.S.C. 103(a) and has further shown that the prior art fails to

provide a motivation to combine the Ovshinsky reference and the Ozin reference as is required to properly support the Examiner's rejection under 35 U.S.C. 103(a). Applicant accordingly requests that this rejection be removed.

**From Paragraph 4 of Office Action**

**Claims 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ovshinsky et al. (US 6,087,580) in view of Ozin et al. (US 5,320,822) as applied to claim 1 above, in view of Tsuo et al. (US 5,627,081) substantially as set forth in the Office Action mailed on 03/27/2003.**

For the reasons discussed in connection with the rejection over Ovshinsky et al. (US 6,087,580) in view of Ozin et al. (US 5,320,822) under 35 U.S.C. 103 (a) above, applicant respectfully requests that this rejection be removed.

**Claim Rejections – Double Patenting**

**From Paragraph 6 of Office Action**

**Claims 1 – 19 and 31 – 34 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 – 18 of U.S. Patent No. 6,087,580 in view of Ozin et al. (5,320,822) for the reasons set forth in paragraph no. 3.**

For the reasons discussed in connection with the rejection over Ovshinsky et al. (US 6,087,580) in view of Ozin et al. (5,320,822) under 35 U.S.C. 103 (a) above, Applicant believes that Applicant's claims are patentably distinct from those of Ovshinsky et al. (US 6,087,580) in view of Ozin et al. (5,320,822) and respectfully requests that this rejection be removed.

### SUMMARY

The remaining claims in the application are claims 1 – 20 and 31 – 38. In view of the above remarks, Applicant believes that all rejections of claims 1 – 20 and 31 – 34 have now been obviated and that these claims are allowable over the references cited by the Examiner. Applicant further believes that unexamined dependent claims 35 – 38 stand allowable in view of the above remarks. Applicant respectfully requests withdrawal of all outstanding rejections and submits that the application stands in condition for allowance. Should the Examiner have any questions or suggestions regarding this amendment or Applicant's prosecution of this application, he is respectfully asked to contact Applicant's representative at the telephone number or email address listed below.

Respectfully submitted,



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